March 1, 2010

City of Greensboro
Environmental Services Department
Attn: Jeryl W. Covington, P.E.,
Environmental Services Director
Post Office Box 3136
Greensboro, NC 27402-3136

Re: Proposal – Waste to Energy and Civil Infrastructure Project

Dear Ms. Covington:

Please find attached ULTURNAGEN, LLC response to the City of Greensboro Request for Proposal to design, finance, and permit the development and operation of a long-term solid waste management infrastructure system. As President and CEO of ULTURNAGEN, LLC, I am empowered to bind this organization in a contractual arrangement with the City of Greensboro. This company has no parent company; and, I answer directly to the company's Board of Directors. Should the City of Greensboro choose to engage in contractual relations with ULTURNAGEN, LLC, full disclosure of the board will be forthcoming.

ULTURNAGEN, LLC was formally incorporated in April of 2009. The address of responsible charge is 3193-C Peters Creek Pkwy #741, Winston-Salem, NC 27127. I am the chief contact person who will be providing the management and oversight for these services. All other information needed related to the financial resources, and professional ability to implement and operate components of the waste management/disposal option shall be provided upon request.

We have introduced to the City of Greensboro City Council the technology that we will employ in a waste to energy project, called gasification, and have had a chance to show the types of industry partners we are capable of bringing into this transaction. We are sedulous in our efforts to formulate the best consortium possible for the success of the project. We offer the City of Greensboro a benefit of constructing a Waste to Energy Facility at no cost to the city and additionally we offer to: (a) complete approximately five (5) miles of the eastern leg of the proposed "loop" highway within the city of Greensboro, N.C.; (b) complete the White Street extension to connect onto Cone Boulevard; (c) construct the waste to energy facility in the proposed 200 acre, industrially zoned area, adjacent to a proposed eastern regional "loop" for the city of

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Greensboro, to be known as the "Greensboro Energy Complex. ". The civil infrastructure upgrades proposed by ULTURNAGEN, LLC will facilitate the transportation of waste to the facility as well as stimulate economic growth for businesses impacted by the "loop" completion.

Budgeted construction costs, when and where applicable, shall be billed to the State of North Carolina and the same terms would be given to the City of Greensboro for the repayment for the White Street extension, which is ten years.

All Tipping fees currently collected by the City of Greensboro landfills, estimated at approximately $7 million per year, shall continue to be paid to the city. All other terms are to be negotiated.

This entire proposal to the City of Greensboro is a package offering and is not separable. The offer made in this proposal will remain valid for acceptance for a period of 120 days from date of submission.

Respectfully Submitted,

Carl E. Lebby, Jr.
President and CEO

THE ULTURNAGEN GROUP

WASTE TO ENERGY AND CIVIL INFRASTRUCTURE PROJECT FOR THE CITY OF GREENSBORO, NORTH CAROLINA

A Proposal to the City of Greensboro
Environmental Services Department
Post Office Box 3136
Greensboro, NC 27402-3136
ATTN: Jeryl W. Covington, P.E.
Environmental Services Director

March 1, 2010

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ULTURNAGEN
The alternative energy.

Overview

ULTURNAGEN, LLC, is an alternative energy development, research, and training company founded on the principle of energy conservation and the subsequent impact we strive to benefit our environment. Ulturnagen provides the very best integration services providing:

- Renewable bio-energy plants worldwide. Using state of the art gasification technology and natural carbon-sequestration to produce clean, reliable electricity, using no fossil fuels and little to no CO2 emissions.
- Turnkey facility products including project development, technical expertise and finance. Our team of experts provides and arrange for all technical services, environmental impact assessment, construction, installation, operation and management.
- Training in energy systems and electric power systems engineering, and construction trades.

ULTURNAGEN Partners and Staff members have extensive years experience in the professional arena as administrative management engineers and consultants for the construction industry. We thoroughly understand the importance of implementing Energy Cost Savings programs, and sustainable building initiatives. ULTURNAGEN has the expertise to provide the necessary support to assist our clients in achieving their specified Energy goals.

Gasification

Gasification is a flexible, reliable, and clean energy technology that can turn a variety of low-value feedstock into high-value products such as base load electricity, fertilizers, liquid biofuels, and chemicals. It is a manufacturing process that converts any material containing carbon—such as coal, petroleum coke (petcoke), or biomass—into synthesis gas (syngas). The syngas can be burned to produce electricity or further processed to manufacture chemicals, fertilizers, liquid fuels, substitute natural gas (SNG), or hydrogen. The Thermoselect process we shall employ in our planned facility is outlined in the attached JFE Technical Report in the attached Appendix-A.

Core Technologies

ULTURNAGEN's core technology lies in a proprietary optimized thermal processing of municipal solid waste (MSW) in an earth friendly manner that minimizes the emission of greenhouse gases yielding the production of electrical energy for smart grid interactions with the local power provider. Our approach offers an additional benefit of producing synthetic liquid biofuels through the use of a dynamic selectable catalyst process that is enhanced by machine intelligent controls.

While ULTURNAGEN does not purport to have invented the thermal processes of MSW, we make this technology work better. In our processing we use elements of thermal processing such as:

Gasification - the process of partial incineration with restricted air supply to create an air-deficient environment, can be used to convert biomass and plastic wastes into synthesis gas with a heating value 10-15% that of natural gas;

Pyrolysis – the chemical decomposition of organic materials by heating in the absence of oxygen or any other reagents, that is used mainly for plastic, and synthetic rubber wastes, and for mixed municipal solid wastes with very high-energy efficiencies:

Plasma and Electric Arc Waste Disposal – this method of waste management that uses high electrical energy and high temperature created by an electrical arc (or nuclear – highly experimental) to break down waste materials primarily into elemental synthesis gas and inorganic sludge.

Benefits

The environmental benefits of our process is: (a) it provides a source of renewable energy –in our society one constant is that we will continue to generate municipal solid waste; (b) it reduces greenhouse gas emissions – when solid waste decomposes, it creates methane which is 23 times more potent than $C0_2$; (c) It supports clean water initiatives.

General Requirements

ULTURNAGEN, LLC will abide by the following requirements from the City of Greensboro concerning the proposed waste management/disposal option(s):

- The proposed waste management/disposal option can be permitted through the North Carolina Department of Environment and Natural Resources – Division of Waste Management as a viable waste management system, the Division of Air Quality, the Division of Land Quality, and the Division of Water Quality as deem appropriate and necessary.
- The proposed waste management/disposal option will satisfy the local zoning requirements as dictated by the City of Greensboro local zoning codes or other jurisdictional bodies.
- The proposed waste management/disposal option is describable as a systematic process (see Appendix-A) including all inputs and outputs, environmental impacts, and discharges.
- The offeror of the proposed waste management/disposal option describes site requirements, relevant transportation routes, and the developable area needs in Appendix-B.
- The proposer has engaged the immediately surrounding community to identify and mitigate any potential negative impacts of our project.
- The proposed waste management/disposal option does not require operational changes to the City's mode of solid waste collection; thus, impeding the collection process or resulting in higher operational costs.
- The proposed waste management/disposal option does not increase or impose any additional liabilities (economic or environmental) on the municipality due to its operations or contractual arrangement.

- The proposed waste management/disposal option is a proven technique, and the proposal offeror is prepared to (at no cost to the city) provide a tour of a like operating gasification facility in the event that a review of the operation(s) is deemed necessary.
- The offeror is prepared to identify and specify performance guarantees (e.g., waste processing as 2000 tons/day for each day of the week per year will be able to export 60MW to the local grid and provide at least of 16 million gallons of bio-fuel per year, with a zero carbon footprint. The resulting vitreous slurry output from the plant will be use in building materials and road fill for the city's and Piedmont Triad's use.
- The offeror is prepared to leverage in excess of $1.5B of financial strength over 5 years to achieve the stated goals of the proposal. The offeror is prepared to establish any bonds necessary on behalf of the development project.
- The proposed waste management/disposal option shall be built to specifications allowing a maximum of maximum daily waste volume of 2,300 tons per day ± 300 tons. The offeror acknowledges that waste volumes will not repeatedly or concurrently meet the maximum daily waste volume throughputs.
- The offeror for the proposed waste management/disposal option will be able to process all waste as collected by municipal forces.
- The offeror for the proposed waste management/disposal option will be responsible for managing any and all potential process residue.
- The offeror for the proposed waste management/disposal option shall be consistent with the State of North Carolina waste reduction goals.
- The offeror for the proposed waste management/disposal option shall assist the City with complying with the State's Solid Waste Management Policy and Goals (N.C. G.S. §130-309.04)
- The offeror for the proposed waste management/disposal option should identify the source of the waste feed stock and volume needed to ensure financial stability of the waste management/disposal option. In the event that the City cannot supply these materials and/or the respected quantities, the offeror for the proposed waste management/disposal operations will be responsible for securing these volumes at their expense and obtaining all required permits.
- The offeror for the proposed waste management/disposal option will consider where applicable a regional implementation strategy.

Signatures and Authorizations

The ULTURNAGEN GROUP is a joint venture (JV) between ULTURNAGEN, LLC and Greenway Research and Training, Inc. As the technical lead of the JV, ULTURNAGEN, LLC (and therefore its President and CEO, Carl E. Lebby, Jr.) is authorized by the JV to sign this transmittal letter. Contractual arrangements require the signatures of CEOs of both ULTURNAGEN, LLC (Carl E. Lebby, Jr.) and Greenway Research and Training, Inc. (T. Hasan). The Principals of the JV are required to bind the ULTURNAGEN GROUP in a contractual arrangement. The Principals of the JV are able and capable of entering into negotiation with the City of Greensboro and execute a contract on behalf of the organization. Otherwise the CEO of ULTURNAGEN, LLC will serve as the JV Chief Executive Officer and Chief Contact person to respond to requests for additional information on behalf of the JV. This offer made in this proposal will remain valid for acceptance for a period of 120 days from its submission.

Requirements and Expectations

ULTURNAGEN, LLC will construct a Waste to Energy Facility at no cost to the City of Greensboro in the Greensboro Energy Complex. We shall build, own and operate the facility for at least 10 years (following construction). After this period, the facility will be deeded to the City of Greensboro as a humanitarian gift. ULTURNNAGEN will offer to services to manage the facility as a contractor there after for the city. The City of Greensboro will be under no obligation to hire ULTURNAGEN, LLC as the managing contractor after the facility has been deeded to the city.

All expected fees charged to the municipality after deeded will be negotiated at a future date (or may be negotiated at the time the current contract is considered.) under this contractual arrangement.

The facility must have a minimum of 1000 tons per day committed by the City of Greensboro for our waste management/disposal option to remain financially viable. The waste volume may contain municipal solid waste (MSW), hazardous wastes (such as paints, oils, medical wastes, farm by-products and wastes, electronic wastes, etc.) , tires, plastics, etceteras.

ULTURNAGEN will disclose sources financial backing and demonstrate financial strength to ensure that the waste management/disposal option is financially secure during the terms of the intended contract.

ULTURNAGEN has no current or historical regulatory compliance issues with any regulatory agency and we shall develop a strategy and be capable of presenting public information and addressing public concerns. We shall provide educational information about our waste management/disposal option to the City of Greensboro, elected official, the regulatory community, public and private educational institutes, and a variety of neighborhood and community groups.

Upon award and authorized contract, ULTURNAGEN will participate in the development and the updating of the Guilford County Solid Waste Plan per N.C. G.S. §130A-309.07, and will assist the City of Greensboro with any and all solid waste transitions as deemed appropriate by the City of Greensboro as a result of procurement of our solid waste management/disposal option services.

ULTURNAGEN will assist and participate with the City of Greensboro in its emergency planning efforts. Minimally, these efforts will include identifying staff, equipment, and processing availability during inclement weather and community emergency events.

Statement of Qualifications

Dr. Gary L. Lebby, will serve as the Chief Staffer for the JV and his qualifications are attached. Dr. Lebby has been a charter member of North Carolina A&T State University Institute for Waste Management (Directed by Dr. Godfrey Uzochukwu since its inception at the University. His expertise in energy systems are detailed in Appendix-C which defines his years of experience, familiarity with our option and knowledge of state and federal regulatory requirements and guidelines.

APPENDIX-A

WASTE TO ENERGY PROCESS METHODOLOGY

JFE TECHNICAL REPORT
No. 3 (July 2004)

Thermoselect Waste Gasification and Reforming Process†

YAMADA Sumio*1 SHIMIZU Masuto*2 MIYOSHI Fumihiro*3

Abstract:

The Thermoselect process is a completely new solid waste treatment process which achieves pollution-free recycling of municipal solid waste and industrial waste by a high temperature gasification and reforming process. The process effectively recovers fuel gas from waste and recycles metal and other byproducts as resources. A stable gas engine power generation system using purified synthesis gas from the Thermoselect process was also developed.

1. Introduction

Japan has made various laws related to recycling, beginning with the Basic Law for Establishing a Recycling-based Society, the Law on Promoting Green Purchasing, and others aimed at creating a recycling-based society. The general purpose of these laws is to reduce waste discharges, promote reuse, and prevent illegal disposal. Reducing discharges and material recycling are essential. However, since some remaining wastes are difficult to recycle as materials, development of an appropriate treatment method for these types of waste is also an important task.

The Thermoselect process[1] is a gasification and melting technology which uses a gas reforming process[2] to recover purified synthesis gas from municipal waste and industrial waste by gasifying the waste and reforming the gas obtained. While minimizing environmental impacts, the process also realizes chemical recycling.

In 1997, the former Kawasaki Steel (now JFE Group) was licensed with the basic technology from Thermoselect S.A., and in 1998, with the financial support of New Energy and Industrial Technology Development Organization (NEDO), began construction of a 300 t/day scale plant called the Chiba Recycling Center (Waste treatment capacity: 150 t/day × 2 lines, **Photo 1**) at the present JFE Steel's East Japan Works (Chiba District). In FY 1999, as part of joint research with Chiba Pref. and Chiba City, the plant completed a demonstrating operation of municipal waste treatment in this facility for a continuous period of 93 days and a total of more than 130 days.[3,4] This was the first demonstration in Japan of a gasification, reforming, and melting equipment on an actual plant scale. Based on these results, Japan Waste Management Association issued a summary of technical verification and confirmation.[5] In FY 2000, the plant began an industrial waste treatment/fuel production business which treats industrial wastes on consignment, producing fuel gas for power generation in the steel works. In 2000, the Thermoselect process became the first gasification and melting plant to receive New Energy Award. In Jan. 2001, the Chiba Recycling Center was transferred to Japan Recycling, a subsidiary of JFE Steel specializing in waste treatment.

This paper describes the results of a performance

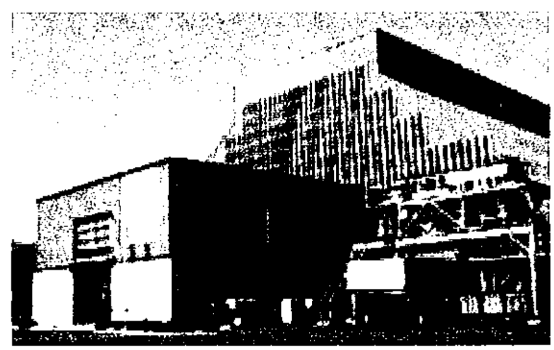

Photo 1 Chiba Recycling Center

† Originally published in *JFE GIHO* No. 3 (Mar. 2004), p. 20–24

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Environmental Industries Engineering Div.,
JFE Engineering

study of municipal solid waste treatment at the Thermoselect process Chiba plant, the condition of the industrial waste treatment/fuel gas business, including the characteristics and use of the gas, and a newly developed gas engine electric power generation system suitable for use with smaller-scale Thermoselect waste treatment plants in areas without major fuel gas-consuming industries.

2. Outline of Thermoselect Technology

2.1 General Process Flow

The standard treatment flow of the Thermoselect process is shown in **Fig. 1**. Wastes are compacted without pretreatment, followed by drying and pyrolysis by indirect heating in the degassing channel. The pyrolyzed waste product is then charged into the high temperature reactor, where it is melted at high temperature by reaction with oxygen and pyrolyzed carbon to form gas. This gas passes through the gas reforming/quenching/refining process and is recovered as a clean synthesized fuel gas.

2.2 Features of Process

The features of the Thermoselect process are described in outline below.

(1) Extremely low emission of dioxins and no generation of fly ash are possible.

Generated gas is held at 1 200°C for 2 s or longer, followed by quenching to approximately 70°C in an oxygen-free condition, to suppress the generation of dioxins to an absolute minimum, and is then recovered as fuel gas.

(2) 100% recycling of wastes is possible.

100% of waste input is converted into purified synthesis gas or recovered in the form of granulated slag, metals, metal hydroxides, S, mixed salts, and other substances which can be used effectively as resources, resulting in zero landfill disposal.

(3) Clean gas can be recovered by gas reforming.

Since the main components of the recovered synthesis gas are H_2 and CO, the gas can be used not only as a fuel for power generation, but also as a chemical feedstock. The fuel gas is applicable to a wide range of power generation methods, including gas engine, fuel cell, gas-fired boiler, and gas turbine combined-cycle power generation, allowing the user to select an optimum generation method from the view points of equipment scale and site conditions.

(4) The process offers excellent economy.

The Thermoslect process utilizes the energy contained in waste to perform melting and eliminates the need for separate treatment processes for dioxins and fly ash with high heavy metal contents. As a result, the total cost is lower than the conventional "incinerator + ash melting". Moreover, because the Thermoselect process eliminates the need for landfill disposal, users can avoid the costs associated with constructing, managing, and maintaining landfills.

3. Results of Waste Treatment at Chiba Plant

3.1 Demonstration of Municipal Solid Waste Treatment

In the demonstration test, approximately 15 000 t

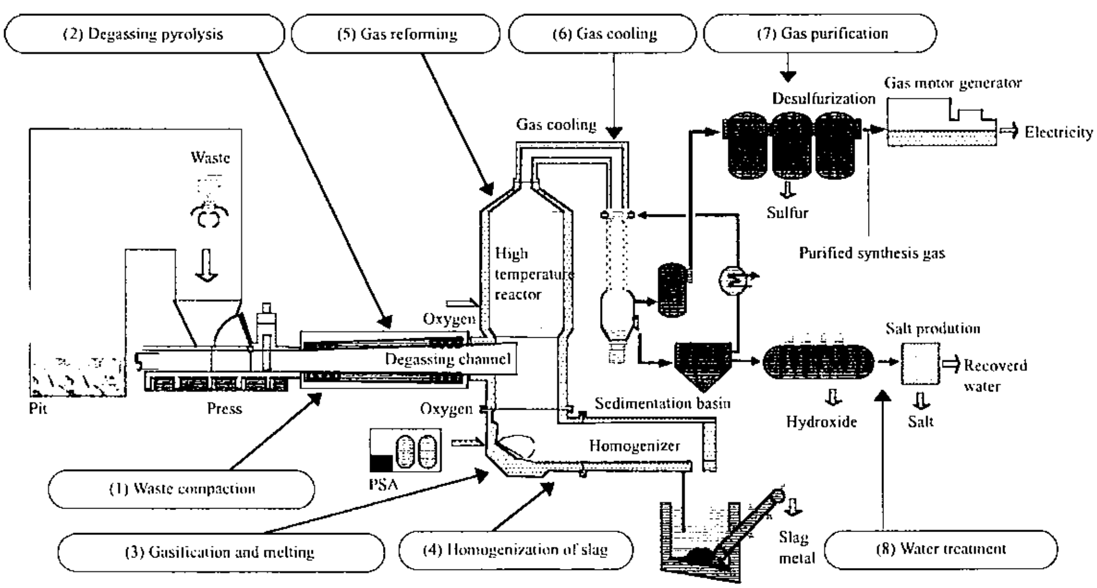

Fig. 1 Thermoselect process

Table 3 Total dioxins emitted at the Chiba Recycling Center (MSW)

By-product	Dioxins content	Recoverd quantity	Dioxins output (μg-TEQ/t-waste)
Synthesis gas	0.000 39 ng-TEQ/Nm^3	722 Nm^3/t-waste	0.000 28
Slag	0.000 7 ng-TEQ/kg-dry	65 kg/t-waste	0.000 04
Sulfur	0.35 ng-TEQ/kg-dry	0.52 kg/t-waste	0.000 18
Metal hydroxide	0.29 ng-TEQ/kg-dry	0.63 kg/t-waste	0.000 18
Recoverd water	0.000 01 ng-TEQ/l	680 l/t-waste	0.000 01
Total dioxins emitted			0.000 69

Table 1 Characteristics of municipal solid waste (MSW)

3 components		
Moisture content	(%)	47.7
Ash content	(%)	6.7
Volatile matter	(%)	45.6
Measured lower heat value	(MJ/kg)	8.5

Table 2 Characteristics of synthesis gas

		Concentration
Component		
H_2	(%)	30.7
CO	(%)	32.5
CO_2	(%)	33.8
N_2	(%)	2.3
Dioxins	(ng-TEQ/m^3)	0.000 39
Dioxins (O_2:12% conversion value)	(ng-TEQ/m^3)	0.000 09

of municipal solid waste (MSW) from Chiba City were treated at the Chiba Recycling Center. The characteristics of this burnable MSW are shown in **Table 1**. An example of the properties of the synthesis gas obtained by treating the MSW is shown in **Table 2**. The concentration of dioxins in the fuel gas was 0.000 39 ng-TEQ/Nm^3 (0.000 09 ng-TEQ/Nm^3, O_2: 12% conversion value[6]), or less than 1/1 000 of the 0.1 ng-TEQ/Nm^3 standard set by Japan's Ministry of the Environment.[7]

Slag quality satisfied the leaching standard in Guideline for Recycling of Melted Solids of Municipal Waste. In the demonstration with MSW from Chiba City, the main metal component was Fe. However, since the average Cu content was as high as 17.5%, it was recovered as a material for Cu smelting. S was recovered as material for H_2SO_4, and metal hydroxides were used as material for Zn smelting as they had a high Zn content. Total release of dioxins was 0.000 69 μg-TEQ/t-waste, which is far below the future target value of 5 μg-TEQ/t-waste (**Table 3**). Considering the fact that the content of dioxins in the charged waste is currently assumed to be around 10 μg-TEQ/t-waste, the Thermoselect process clearly proved its performance in decomposition of dioxins.

3.2 Industrial Waste Treatment/Fuel Production Business

Treatment of industrial waste on a consignment basis began in Apr. 2000. In Apr. 2001, the Chiba Recycling Center also entered the plastic recycling business (licensed for plastic gasification) under the Containers and Packaging Recycling Law. As of Mar. 2003, a cumulative total of more than 170 000 t had been received.

The plant mainly treats construction industry waste. Categories of industrial waste include waste plastics, sludge, wood chips, waste paper, and others, as shown in **Fig. 2**, which also shows the amounts and composition of wastes received. It may be noted that the waste which is classified here as waste plastics (according to industrial waste control manifests) also contains a considerable amount of waste from other categories.

An example of the analysis of received waste is shown in **Table 4** (example of average composition of waste in pit, Sept.–Nov. 2001). Wastes A–D are examples of analysis for each lot of received waste, while waste D is an example of packaging waste plastics. Because the heating value, ash content, and other characteristics of this waste fluctuate widely by lot in comparison with MSW, it is also more important to stabilize waste quality by waste mixing control in this case. The plant therefore adjusts waste receiving, maintains a stock yard, and performs operation with special attention to mixing in the pit.

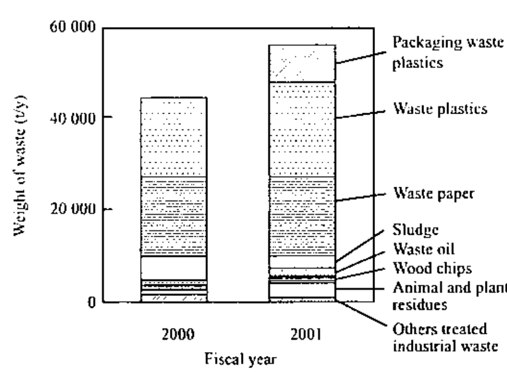

Fig. 2 Composition of waste

Table 4 Characteristics of industrial waste

Industrial waste	LHV* (MJ/kg)	3 Components			Cl (%-wet)	S (%-wet)
		Moisture content (%)	Ash content (%)	Volatile matter (%)		
A	16.1	22.2	15.4	61.9	1.29	0.97
B	5.5	26.8	42.7	30.5	1.11	1.66
C	18.2	46.3	2.0	51.7	0.15	0.17
D	38.3	1.3	1.8	96.9	0.01	–
Average	13.7	44.4	9.8	45.8	1.15	0.64
MSW**	8.5	47.7	6.7	45.6	0.19	0.04

* Lower heating value, ** Demonstration

Table 5 Total dioxins emitted at the Chiba Recycling Center (Industrial waste)

By-product	Dioxins content	Recoverd quantity	Output of dioxin (μg-TEQ/t-waste)
Synthesis gas	0.000 30 ng-TEQ/Nm^3	826 Nm^3/t-waste	0.000 248
Slag	0.000 49 ng-TEQ/kg-dry	109 kg/t-waste	0.000 053
Metal	0.000 13 ng-TEQ/kg-dry	24.1 kg/t-waste	0.000 003
Sulfur	0.002 2 ng-TEQ/kg-dry	2.23 kg/t-waste	0.000 005
Metal hydroxide	0.000 68 ng-TEQ/kg-dry	2.29 kg/t-waste	0.000 002
Recoverd water	0.000 06 ng-TEQ/l	899 l/t-waste	0.000 000
Total dioxins emitted			0.000 31

Table 6 Characteristics of synthesis gas

Component	Concentration
H_2 (%)	32.4
CO (%)	43.1
CO_2 (%)	18.8
LHV (MJ/Nm^3)	8.9

The average properties of the waste in the pit after mixing include a lower heating value (LHV) of 13.7 MJ/kg, and ash content of 9.8%, Cl content of 1.15%, and S content of 0.64% (waste standard).[8] Thus, in comparison with MSW, LHV is large and the ash, Cl, and S contents are high (compared with MSW received from Chiba City during demonstration). Based on the large amount of metal hydroxides recovered, this industrial waste also has a high content of heavy metals (**Table 5**).

Table 6 shows an example of the characteristics of the synthesis gas obtained by treating industrial waste. Table 5 shows the distribution and total amount of dioxins. Total emission of dioxins was 0.000 30 μg-TEQ/t-waste, which is virtually the same level as in the demonstration with MSW.

Slag quality satisfies leaching standards. Slag quality control includes on-line size adjustment and magnetic classification. Quality confirmation tests with recycling contractors have been completed for respective applications, and Thermoselect slag is now being used as fine aggregate for interlocking blocks, etc.[9]

3.3 Use of Purified Synthesis Gas

Since 1987, JFE Steel's East Japan Works (Chiba District) has operated a gas turbine combined-cycle power plant[10] using byproduct gases generated in the steel works (Blast furnace gas, coke oven gas, etc.; LHV: 4.6 MJ/Nm^3). Therefore, the purified synthesis gas recovered by the Thermoselect process is transferred to the works, where it supplies part of the fuel for the combined-cycle power plant. **Figure 3** shows the energy flow at Chiba District of East Japan Works, including the purified synthesis gas from the Chiba Recycling Center.

In cases where a Thermoselect process plant is sited at a steel works or similar energy-consuming facility, it is possible to use the purified synthesis gas in the works. However, under general siting conditions, highly efficient power generation on a comparatively small scale is required in order to utilize the purified synthesis gas recovered by waste treatment. Conceivable generating methods for such small-scale waste treatment operations include gas engine power generation and fuel cells, as these methods offer high generating efficiency with small-scale equipment.

To demonstrate the effectiveness of the Thermoselect process in this type of power generation, a 1.5 MW gas engine generator was installed at the site of the Chiba Recycling Center for demonstration. The appearance of the generator is shown in **Photo 2**; its main specifications are shown in **Table 7**. A demonstration test of gas engine power generation was performed using part of the

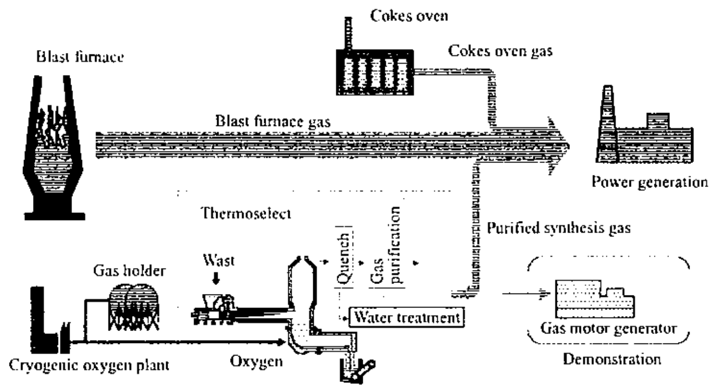

Fig.3 Energy flow at Chiba District of East Japan Works

Photo 2 Gas motor generator

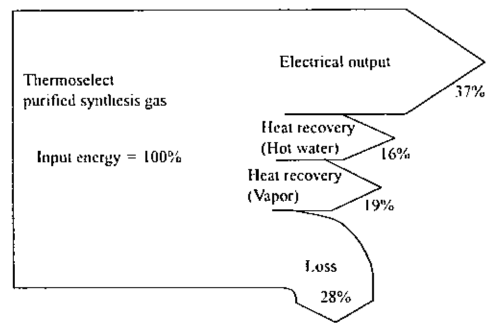

Fig.4 Energy balance at 100% load

Table 7 Specifications of gas motor generator

Type	Lean-burn engine
Electrical output (kW)	1 507
Cylinders	20
Bore/Stroke (mm)	190/220
Rotation (rpm)	1 500
Maker	Jenbacher

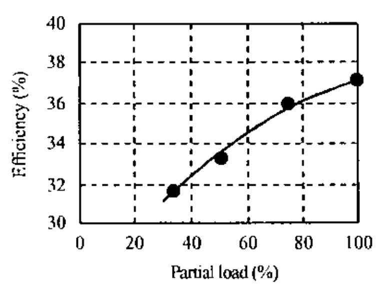

Fig.5 Electrical efficiency in partical load

Table 8 Emission of gas-engine

DXNs	($ng\text{-}TEQ/Nm^3$)	0.000 007 2
Dust	(mg/Nm^3)	0.2
NOx	(ppm)	14
HCl	(mg/Nm^3)	< 5

fuel gas supplied to the steel works. Since the properties of the gas generated by the Thermoselect process tend to fluctuate, depending on waste properties, the gas engine generating system includes a control system which maintains a constant output based on external signals by changing the air ratio in response to the change in heating value of the fuel gas. Constant generating operation was possible in spite of fluctuations in the heating value of the fuel gas. The energy balance in gas engine generation at 100% load is shown in **Fig. 4**. The generating efficiency of the gas engine generator itself was 37% at rated load, and combined efficiency was 72%. **Figure 5** shows generating efficiencies under various partial load conditions. In comparison with 37% efficiency at 100% load, 33% efficiency was maintained at 50% load, which was a decrease of only 4% from rated (100%) load.

Table 8 shows an example of the measured values of toxic substances in the gas engine exhaust gas by O_2: 12% conversion, which confirm that the dioxin content of the gas engine exhaust gas is low. Exhaust gas NOx is also low, even without denitrification.[11]

At present, a highly efficienct (50–60%) fuel cell is being developed. Thus, in the future, it will be possible to achieve even higher equipment efficiency by applying the Thermoselect process.

4. Summary

The Thermoselect process described in this paper offers numerous advantages as a waste treatment system. In particular, it can cope effectively with a diverse range of wastes in fuel gas recovery, it has demonstrated outstanding dioxins decomposition performance, and it is capable of direct reduction of nonferrous metals such as Zn at the site. JFE Engineering is confident that this technology can contribute to realizing a recycling-based society without final landfill disposal sites.

At present, orders have been received for the following Thermoselect process waste treatment facilities, which are now under construction.

(1) Mizushima Eco-Works Corp. (Okayama Pref.)
Treatment capacity: 555 t/d
(scheduled startup: 2005)

(2) Kenoukennan Regional Environmental Association (Nagasaki Pref.)
Treatment capacity: 300 t/d
(scheduled startup: 2005)

(3) Cyuoukouiki Environmental Facility Association (Tokushima Pref.)
Treatment capacity: 120 t/d
(scheduled startup: 2005)

(4) Yorii ORIX Eco Services Corp. (Saitama Pref.)
Treatment capacity: 450 t/d
(scheduled startup: 2006)

References

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3) Iwabuchi, T. "Heisei 12 Nendo Gomishokyaku Yonetsuyokoriyou Sokushin." Shichosontou Renrakukyogikai. 2000, p. 82–94.
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APPENDIX-B

SITE REQUIREMENTS AND RELEVANT TRANSPORTATION ROUTE UPGRADES AND CONSTRUCTION

Greensboro began planning the "Urban Loop" in the early 1990's. Although partially finished on the west side of Greensboro, the need for the remaining sections of the Urban Loop continues to increase as the city continues to grow, daily trip origins and destinations become more dispersed throughout the area, and freight movement becomes an increasingly significant economic sector.

Once completed, the remaining portions of the Urban Loop will complete a high capacity circumferential freeway serving cross-town traffic demands in the area. From a traffic perspective, the area is relatively well prepared for the facility due to the effective system of radial roadways through the area. The Urban Loop will provide critical links to anticipated high growth areas around the airport and in east Greensboro.

ULTURNAGEN, LLC, proposes to complete the remaining incomplete sections of the Urban Loop, first starting with a five (5) mile section on the east side which are critical to economic development in Greensboro. The City has developed an effective system of radial roadways radiating out to the northern periphery but lacks adequate cross town circulation in that area. The remaining section of the Urban Loop will meet travel demands in this area and will provide critical links to anticipated high growth areas around the airport and in east Greensboro.

Additionally, the completion of the Urban Loop on the East Side of Greensboro will significantly enhance the competitive position of the increasingly important economic cluster of Industrial and research based offerings in the enclosed area of the loop by the inclusion of a "Waste to Energy Gasification" facility. Greensboro has currently closed its landfill to Municipal Solid Waste (MSW) The costs to current deal with the MSW generated is to contract for waste to be removed nearly 80 miles out of town to a nearby Montgomery County site. The current cost of trash disposal exceeds $7M/year and is escalating.

Gasification is a flexible, reliable, and clean energy technology that can turn a variety of low-value feedstock into high-value products such as base load electricity, fertilizers, liquid biofuels, and chemicals. It is a manufacturing process that converts any material containing carbon—such as coal, petroleum coke (petcoke), or biomass—into synthesis gas (syngas). The syngas can be burned to produce electricity or further processed to manufacture chemicals, fertilizers, liquid fuels, substitute natural gas (SNG), or hydrogen.

An attractive solution for Greensboro is to use a fourth generation gasification technique along with advanced machine intelligence based controls for: (a) producing biodiesel and biojet fuels that have been certified by the Air Force and meet all requirements for use in flight; (b) intelligent dynamic control of placing energy on-demand to the local power utility grid using Smart-Grid Protocols; (c) dynamic selectable catalysts for control of synthetic biofuel output. Also we will consider a closed-loop algae process for sequestering carbon so that our plants are carbon negative with a very cost effective and efficient closed loop system with no emissions and no pollution.

Requirements

The site for the Waste to Energy facility requires approximately 20 acres of land with adequate infrastructure and availability to high capacity electric power lines. The plant will produce approximately 20 million gallons per year in biofuels and 40 MW renewable power. The ensuing plant is designed to be energy self-sufficient. The area for the plant cannot include building on a fault line, wet lands, etc. the ground should be stable for carrying buildings, traffic, and weight. The exact fuel to electric power mix from the plan shall be determined precisely in the conceptual design phase with the City of Greensboro.

Design Process
The design process proceeds as follows for the Waste to Energy facility:

1. Conceptual Design and Front-End Engineering Design are two design steps required prior to construction. At the same time, permitting issues need to be resolved, as well as the financial package.
2. ULTURNAGEN, LLC and the winning bid contractor, and the City of Greensboro may form a special purpose entity (SPE) to own and operate the plant will be a public-private partnership with ULTURNAGEN, LLC being the funding part of the equation and the training part of the equation. Details of the SPE will be negotiated with the city.
3. Any issues with permitting and licensing will be resolved in an agreement that forms the SPE and its operation and management.

Construction Process

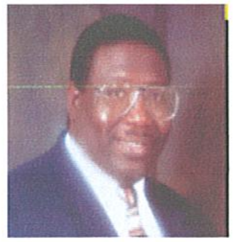
From ground breaking to startup, ULTURNAGEN requires 18 to 24 months in construction time. We would be responsible for construction and start-up. This work will be contracted out with a contractor with a quality history of constructing power plants (i.e. a bid process will be held t determine this contractor). The construction will be covered with a wrap performance warranty, which covers the plant for 30 days after first day of start up. We will pay this initial warranty. there may be additional operational costs associated with the plant warming up and stabilizing the reactor.

Other Subcontractors
ULTURNAGEN will employ highly qualified partners who participate in the construction of a plant and provide the equipment required (e.g., GE supplies turbines. compressors. BECHTEL for integration processes.)

APPENDIX-C

RESUME/ QUALIFICATIONS

GARY L. LEBBY



Chief Development Officer
ULTURNAGEN, LLC
Phone: (336) 255-3164; Fax: (803) 233-3685
E-mail: lebbyg@ ulturnagen.com

PLACE OF BIRTH: Charleston, South Carolina

BIOGRAPHICAL SUMMARY

Gary L. Lebby – received the BS degree in mathematics (minor in Computer Science) and the BS degree in physics in 1980, and the MS degree in physics in 1982, from the University of South Carolina, and the Ph.D. in electrical engineering from Clemson University in 1985. In 1985 he accepted the position of Assistant Professor of Electrical Engineering at North Carolina Agricultural and Technical State University. In 1992, he was promoted to Associate Professor, and was appointed Chairperson of Electrical Engineering in 1994. In 1996, he was promoted to Professor. In 1998, he graduated the first doctoral student from North Carolina Agricultural and Technical State University (newly formed) doctoral program. In 2009 Dr. Lebby was appointed by the Dean of the College of Engineering to plan for a graduate M.S Program in Energy Systems Engineering to meet the national demand for Energy Professionals. Dr. Lebby currently serves as the Chief Development Officer of ULTURNAGEN, LLC, as spin off company from University research and developments in Biologically Inspired Energy and Engineering Systems, and his areas of research include: Power Systems Modeling, Artificial Neural Systems, and Parallel Distributed Processing. Dr. Lebby also serves as a reviewer for the U.S. Department of Energy for Smart Grid and Energy Systems proposal submissions.

EDUCATION

Ph.D.: Electrical and Computer Engineering, 1985, Clemson University, Specialty - Power Systems Modeling and Artificial Intelligence, Clemson, South Carolina.

M.S: Physics, 1982, University of South Carolina, Specialty - Modeling of Optical Systems and Software Simulations, Columbia, South Carolina.

B.S.: Physics, 1980, University of South Carolina, Columbia, South Carolina.
Mathematics, 1980, University of South Carolina, Columbia, South Carolina.

Minor: Computer Science, 1980, University of South Carolina, Columbia, South Carolina.

EMPLOYMENT (Promotions and Appointments)

2/08 – Present: Chief Development Officer of ULTURNAGEN, LLC.

2/99 – Present: Research Professor, Department of Electrical Engineering - Chair of Research Excellence, North Carolina A&T State University, Greensboro, North Carolina.

6/96 – Present: Professor of Electrical Engineering, North Carolina A&T State University, Greensboro, North Carolina.

1/95 – 1/99: Chairperson, Department of Electrical Engineering, North Carolina A&T State University, Greensboro, North Carolina.

2/94 - 1/95: Interim Chairperson. Department of Electrical Engineering. North Carolina A&T State University. Greensboro. North Carolina.

5/92 – 5/96: Associate Professor of Electrical Engineering. North Carolina A&T State University. Greensboro. North Carolina.

8/92 – 1/96: Area Director for Power Systems and Controls. Department of Electrical Engineering. North Carolina A&T State University. Greensboro. North Carolina.

1/86 – 4/92: Assistant Professor of Electrical Engineering. North Carolina A&T State University. Greensboro. North Carolina.

8/82 8/85: Research Associate. Clemson University Electric Power Research Association Modeling southeastern utilities power system load transients. Clemson. South Carolina.

8/82 – 8/85: Research Associate . J. F. Leathrum. Chair of Software Engineering – Theoretic Software Physics and Proof of correctness military ADA Compiler. Clemson. South Carolina.

5/83 – 8/83: Telecommunications and Software Engineer. Operations Management. South Carolina Electric & Gas Company - Installation and maintenance of computer data links for the Columbia and Charleston computer data links. Columbia, South Carolina.

12/80 – 5/82: Graduate Researcher - Digitally simulated holograms. University of South Carolina Center for Vision Research.

5/80 8/80: Engineering Trainee – Design and Implementation of Cherenkov Detector Logic and Real-time Hardware/Software Integration. Fermi National Accelerator Laboratory. Botavia. Illinois.

CONSULTING AND SYNERGISTIC ACTIVITIES

4/09 – Pres. Smart Grid Review Team. Energy Workforce Training. Office of Electricity Delivery and Energy Reliability. U.S. department of Energy.

3/08 – Pres. Member of the Board of Directors. W2COG Institute (World-Wide Consortium for the Grid.)

10/07 – Pres. Founding Member and Member of the Board of Directors. Triad Science and Math Academy.

7/05 Appointed to the Educators in Space Selection Committee. NASA.

10/05 Appointed to the Aero Capture Focus Group. NASA.

3/04 – 4/09 Associate Editor. International Journal of Power and Energy Systems.

3/95 – 8/95 Ms. Sonya Stinson. Editor. The Black Collegian Magazine. Most Promising Careers In Electrical Engineering. New Orleans. LA.

3/93 – 2/94 Dr. William C. Latham. Neural Network Cluster Design. Kodaira-shi. Tokyo. Japan.

8/92 – 7/95 National Institutes of Health, National Library of Medicine, Preceptor in the USRP Program, Bethesda. Maryland.

2/90 – 9/99 Battelle. Inc.. Chaired the Electrical Engineering Council on Defense Scholarships. Research Triangle Park. North Carolina.

7/88 - 12/94 NeuroGuru. Inc.. Development of Neural Network Applications for Signal Processing and Pattern Recognition. Greensboro. North Carolina.

5/87 – 8/87	NASA-Langley. Researcher. SIMNET Summer Institute for Engineering. Physics and Computer Science. Establishing Computer Laboratory Environment in Engineering for Hampton University. Hampton. Virginia.
5/84 – 6/84	SCE&G Company. Inc.. Coordinated the installation of the GENESIS Power System Load Modeling Software on the IBM 3081 Mainframe at the Load Management Site. Columbia. South Carolina.

RESEARCH, CONTRACTS & GRANTS

[PI] Minority Institution Technology Support Services-II (DISA-MITSS II), Defense Information Systems Agency. Funding: $16,000,000 (IDIQ). 2005 - 2009.

[PI] Minority Institution Technology Support Services (DISA-MITSS), Defense Information Systems Agency. Funding: $24,000,000 (IDIQ). 1999-2004.

[PI] Computer Telephony Integration Testbed, National Security Agency, Funding: $259,996. 1997-1999.

[PI] Improving Engineering and Science Education at Technikon-Access to U.S. Expertise, Tertiary Education Linkages Project, Howard University, Funding: $60,000. 1996-1998.

[PI] Undergraduate Power System Laboratory Development, National Science Foundation, Funding: $56,548. 1992-1995.
[PI] Enhanced Computer System Performance and Reliability for Real-Time Object Recognition, Advanced Research Projects Agency, Funding: $1,375,000. 1993-1996.

[PI] Undergraduate Power System Laboratory Development, National Science Foundation, Funding: $56,548. 1992-1995.

[PI] Machine Intelligence Methods in Power System Planning, U.S. Department of Energy, Bonneville Power Administration, Funding: $343,123. 1991- 1994.

[PI] Neural Signal Processing Systems Development, U.S. Department of Defense, National Security Agency, Funding: $284,141. 1989-1994.

[PI] AC Electrostatic Field Study, U.S. Department of Energy, Bonneville Power Administration, Funding: $60,258. 1989-1990.

[PI] The Development of Two Dimensional Object Identification Techniques, National Aeronautics and Space Administration, Langley Research Center, Funding: $124,998. 1988-1989.

[PI] Development of Electrostatic and Electromagnetic Field Measuring Techniques, Bonneville Power Administration, Funding: $53,843. 1986-1988.

[Co-PI] The Center for Autonomous Control Engineering, National Aeronautics and Space Administration. Funding: $2,000,000. 1997-2000.

[Co-PI] Laboratory for Communications, Signal Processing, Expert Systems and Application Specific Integrated Circuit Design, National Science Foundation, Funding: $2,500,000. 1989-1994.

[Co-PI] Kellogg Center of Excellence in Graduate Engineering, The Kellogg Foundation, Funding: $3,000,000. 1992 -1994.

[Co-PI] Wavelet Transform Data Compression Study, McDonnell Douglas Corporation, Funding: $45,966. 1992-1994.

[Co-PI] Human Factors Prototyping Capability Development, U.S. Department of Defense, National Security Agency, Funding: $77,274. 1988-1989.

PUBLICATIONS AND PRESENTATIONS

1. G. L. Lebby and J. D. Tabron, "The Role of Biologically Inspired Systems at North Carolina Agricultural and Technical State University," Invited Lecture: Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, MA, August 4, 2008.
2. C. Shavers, R. Li, and G. Lebby, "An SVM-based Approach to Face Detection," 38th Southeastern Symposium on System Theory, Tennessee Technological University, Cookeville, TN, USA, March 5-7, 2006.
3. W. N. Martin Jr., A. Ghoshal, A., M. J. Sundaresan, G. L. Lebby, P. R. Pratap, M. J. Schulz, "An Artificial Neural Receptor System for Structural Health Monitoring," Structural Health Monitoring, Vol. 4, No. 3, pp. 229-245, SAGE Publications, 2005.
4. M. Ahmed, G. Lebby, "Lightning Induced Fault Classification in Transmission Lines Using Artificial Neural Networks," International Conference on Intelligent Systems, Malaysia, September, 2005.
5. G. L. Lebby, K. M. Stevenson, and G. H. Shi, "Power System Load Modeling Using a RBF GRNN with Self-Starting Centers," IASTED International Conference PowerCon 2003 (Special Theme: BLACKOUT) , New York, USA, December 2003.
6. G. L. Lebby, A. B. Darmand, and K. J. Jones, "A Parallel Distributed Method for Power System Load Flow," IASTED International Conference PowerCon 2003 (Special Theme: BLACKOUT) , New York, USA, December 2003.
7. Martin, W. N., Ghoshal, A., Sundaresan, M.J., Lebby, G.L., Schulz, M.J. and Pratap, P.R. "Artificial Nerve System for Structural Monitoring," Proceedings of 9th SPIE Conference, pp. 4702-05, San Diego, March 2002.
8. G. Lebby, "Load Shape Models for Power System Planning using a Load Shape Metric," IASTED International Conference on Power and Energy Systems, July 2001.
9. A. Darmand, G. Lebby, F. Williams, K. Stevenson and A. LaPrade, Jr. "Power System Load Characterization of a Southeastern Electric Power Cooperate Using Neural Networks and Statistical Methods," IASTED International Conference on Power and Energy Systems, July 2001.
10. William N. Martin Jr., Anindya Ghoshal, Gary Lebby, Mannur J. Sundaresan, Mark J. Schulz, Promod R. Pratap, "Artificial Nerves for Structural Condition Monitoring," Third Workshop on Structural Health Monitoring, Stanford, CA, September 12-14, 2001.

11. D. Chance, G. L. Lebby, M.C. King, and M. J. Cooke, "Unsupervised Mapping of Biometric Signatures for Enhanced Computer Security," IASTED International Conference on Artificial Intelligence and Soft Computing, May 2000.

12. M.C. King, G. L. Lebby, and K. Ricanek, Jr., "A Dialog Control Strategy Using A Hierarchical Controller of Mutually Exclusive Neural Experts," IASTED International Conference on Artificial Intelligence and Soft Computing, May 2000.

13. S. Baghavan, R. Li, G. Lebby, and E. Sherrod, "Performance Comparisons Between a RBF Network and Multilayer Backpropagation Network", 12th International Conference on Computer Applications in Industry and Engineering (CAINE-99), Atlanta 1999.

14. G. L. Lebby, "Pattern Classification using a Minimum Volume Ellipsoidal Neural Network," IASTED International Conference on Artificial Intelligence and Soft Computing, May 1998.

15. M. C. King and G. L. Lebby, "Pattern Classification using Parallel Neural Systems," IASTED International Conference on Artificial Intelligence and Soft Computing, May 1998.

16. M. J. Cooke and G. L. Lebby, "Nested Parallel Neural Network Configuration using Evolutionary Strategies," IASTED International Conference on Artificial Intelligence and Soft Computing, May 1998.

17. M. J. Cooke, Z. Salami, and G. L. Lebby, "Parallel Power Systems Analysis using Heterogeneous Neural Networks," IASTED International Conference on Artificial Intelligence and Soft Computing, May 1998.

18. M. J. Cooke and G. Lebby, "An Optimal Design Method for Multilayer Feed forward Neural Networks," IEEE 30th Southern Symposium on System Theory, 1998.

19. K. Ricanek, M. J. Cooke, and G. L. Lebby, "A Novel Method of Wireless Power for Electric Vehicles," AVCS'98, 1998.

20. S. Baghavan, R. Li, G. Lebby, and E. Sherrod, "New Approaches of Radial Basis Function Networks (RBFNs) for Pattern Classifiers", Proceedings of the Joint Conference of Information Science (JCIS) Vol. IV, Research Triangle Park, N.C., October, 1998.

21. T. Evers, C. Pierre, G. L. Lebby and Y. D. Song, "On Voltage Collapse Prediction in Power Systems: A Case Study" 30th Southeastern Symposium on System Theory (SSST), March 1998, pp. 354-359.

22. Bryson, S., Homaifar, A., Lebby, G. and Bikdash, M., "Job Scheduling using Genetic Matrix Crossover Operator with 2-Opt Inversion," Special Issue of the International Journal of Intelligent Automation and Soft Computing, April 1997, pp. 63-76.

23. R. Y. Li and G. L. Lebby, "Fast Image Vector Quantization Using a Modified Kohonen's Self-organizing Neural Network Approach,", International Journal of Imaging System and Technology, 1997.

24. Robert Y Li, Gary L. Lebby, and Huaxioa Si, "A Modified Approach for Constructing the Self-Organized Layer in a Multilayer Feedforward Neural Network," International Journal on Information Sciences, Vol. 98, No. 1-4, pp. 68, 1997.

25. S. Bryson, A. Homaifar, E. Gardner, and G. L. Lebby, "Classical Genetic Algorithms for Job Scheduling," Proceedings of the World Automation Congress, Soft Computing with Industrial Applications, Recent Trends in Research and Development, Editors: M. Jamshidi, M. Fathi, and F. Pierrot, TSI Press Series, vol.5, pp. 101-106, Montpellier, France, May 28-30, 1996.

26. N. Bonner, Y. D. Song and G. Lebby, " On Power Factor Correction and Application," American Power Conference, April 1995.

27. G. L. Lebby, E. E. Sherrod, and M. T. Rahman, "Noise Cancellation in the Time and Frequency Domain Using Neural Networks," 5th International Symposium on Robotics and Manufacturing, WP6-8, 1994.

28. M. J. Cooke and Gary L. Lebby, "A Backpropagation Alternative to the Classical Power Flow Algorithm," ANNIE'94, 1994.

29. G. Lebby and M. Rahman, "Time and Frequency Domain Filtering Using Neural Networks," IFAC '94, 1994.

30. G. Lebby and M. Rahman, "Neural Signal Classification using Neural Networks," IEEE 24th Southeastern Symposium on System Theory, Vol. 25, No. 1, March 1992, pp. 380-383.

31. G. L. Lebby, "Automated Power System Planning," IEEE 24th Southeastern Symposium on System Theory, Vol. 25, No. 1, March 1992, pp. 380-383.

32. M. Cooke and G. L. Lebby, "Power System Transient Analysis Using Discrete Time Modeling," IEEE 24th Southeastern Symposium on System Theory, Vol. 25, No. 1, March 1992, pp. 389-391.

33. M. C. King and G. L. Lebby, "Multivariable Function Interpolation Using a GMDH Network," IEEE 24th Southeastern Symposium on System Theory, Vol. 25, No. 1, March 1992, pp. 465-468.

34. G. L. Lebby and C. Y. Hu, "A Multi-layer Neural Network for Signal Processing," IEEE 2nd Annual Symposium on Communications, Signal Processing Expert Systems, and ASIC VLSI Design Symposium, March, 1991.

35. G. L. Lebby, "Power System Load Modeling Using a Statistically Trained Feed Forward Group Method of Data Handling (GMDH) Network," Sixth IASTED International Conference on Expert Systems and Neural Networks, August 1990.

36. D. M. Hulen and G. L. Lebby, "Covariance Matrix Simulator Using Neural Networks," Communications, Signal Processing Expert Systems, and ASIC VLSI Design Symposium, March, 1990.

37. G. L. Lebby, "Two Dimensional Object Identification Using a Gradient Based Metric Technique," 1st Symposium on Communications, Signal Processing Expert Systems, and ASIC VLSI Design Symposium, March 1990.

38. C. Y. Hu and G. L. Lebby, "Solving the Short-term Load Forecasting Problem by Using an Expert System Based Algorithm," 1st Symposium on Communications, Signal Processing Expert Systems, and ASIC VLSI Design Symposium, March 1990.

39. S. F. Harris and G. L. Lebby, "Lowpass Filter Simulator Using Neural Networks," 1st Symposium on Communications, Signal Processing Expert Systems, and ASIC VLSI Design Symposium, March 1990.

40. G. L. Lebby, "The Development of Electrostatic and Electromagnetic Field Measuring Techniques," Final Report on Grant # DE-AI79-84BP19395, Department of Energy, Bonneville Power Administration, 1989.

41. G. L. Lebby and E. E. Sherrod, "The Development of Two-Dimensional Object Identification Techniques," Final Report on Grant # NAG-1-870, NASA Langley Research Center, 1989.

42. G. L. Lebby, E. E. Sherrod, and J. Deebs, "Human Factors Prototyping Capability Development," Final Report on Contract # MDA-1-98363-89, NSA, Forte Meade, 1989.

43. G. L. Lebby, "Planar Recognition Using a Gradient-Based Shape Metric," Minnesota Mining and Manufacturing, Pattern Recognition Group, Minneapolis, MN., September, 1988.

44. G. L. Lebby and J. R. Matherson, "A Two Dimensional Object Recognition System," NASA-HBCU Workshop, Hampton, VA 1988.

45. G. L. Lebby, "Load Modeling Studies at North Carolina A&T State University," North Carolina Alternative Research Corporation, Research Triangle Park, May, 1987.

46. G. L. Lebby, "Two-Dimensional Object Recognition Techniques," NASA-Langley, Structures and Dynamics Division, Hampton, VA, July, 1987.

47. H. Martin, A. Kumar, S. Velamuri and G. Lebby, "On Line Monitoring and Real Time Control of Power Systems," IEEE Transactions on Power Systems, August, 1987.

48. G. L. Lebby, Load Modeling in Southeastern Utility Systems, Dissertation, Clemson University, 1985.

49. G. L. Lebby and R. W. Gilchrist, "Load Modeling with Weather Sensitive Component," IEEE 15th Southeastern Symposium on System Theory, Vol. 16, No. 1, March 1983, pp. 199 204.

50. G. L. Lebby, Depth Perception in Random Dot Stereograms, Thesis, University of South Carolina, 1982.

DOCTORAL STUDENTS SUPERVISED

1. Sidney L. Bryson, Ph.D. E.E., "Cognitive Visual System Incorporating Stereopsis," Dissertation, North Carolina Agricultural and Technical State University, 1998.
2. Michal J. Cooke, Ph.D. E.E.,"A Cellular Wireless Power System Architecture," Dissertation, North Carolina Agricultural and Technical State University, 1998.
3. Karl Ricanek, Jr., Ph.D. E.E., "Variable Lateral Pose Face Recognition using Anthropometric Analysis," Dissertation, North Carolina Agricultural and Technical State University, 1998.
4. Zia Salami, Ph.D. E.E.,"Controlling Power System Transients using Transient Analysis of Control System (TACS) Modules," Dissertation, North Carolina Agricultural and Technical State University, 1998.
5. Mohiuddin Ahmed, Ph.D. E.E., "Line-to-ground Fault Protection using Artificial Neural Network Relays in Power Transmission Lines," Dissertation, North Carolina Agricultural and Technical State University, 2000.
6. Michael C. King, Ph.D. E.E., "Spoken Language Command Identification using Adaptive Neural Experts," Dissertation, North Carolina Agricultural and Technical State University, 2001.
7. Katherine M. Stevenson, Ph.D. E.E., "Multi-dimensional Clustering Neural Networks for User Identification Using Data-Entry Biometrics," Dissertation, North Carolina Agricultural and Technical State University, 2004.
8. Felicia R. Williams, Ph.D. E.E., "Optimal Economic Dispatch with Predictive Neural Autoregressive Integrated Moving Average Modeling of a Power System," Dissertation, North Carolina Agricultural and Technical State University, 2004.
9. Audley B. Darmand, Ph.D. E.E., "Enhanced Remote Terminal Units (RTUs) for Power System Analysis," Dissertation, North Carolina Agricultural and Technical State University, 2004.

MASTERS STUDENTS SUPERVISED

1. Angela Rene Fisher, M.S.E.E., "Modeling of Gallium Arsenide Mesfet Device Integrated Circuits," Thesis, North Carolina Agricultural and Technical State University, 1990.
2. Charlene M. Carter, M.S.E.E, "Query Optimization in a Distributed Relational Database Using AI Search Strategies," Thesis, North Carolina Agricultural and Technical State University, 1991.
3. Cheng-Yen Hu, M.S.E.E., "Implementations of Neural Networks for Signal Processing and Pattern Recognition," Thesis, North Carolina Agricultural and Technical State University, 1991.
4. Donna M. Hulen, M.S.E.E., "North Carolina A & T Advisor: An Integration of Relational Databases and Neural Networks," Thesis, North Carolina Agricultural and Technical State University, 1991.
5. DeWayne R. Brown, M.S.E.E., "Computerized Graduate Power Laboratory Design for Primary Distribution Systems," Thesis, North Carolina Agricultural and Technical State University, 1992.
6. Mohiuddin A. Ahmed, M.S.E.E., "Outage Simulation Expert System," Thesis, North Carolina Agricultural and Technical State University, 1993.
7. Lisa Antoine, M.S.E.E., "The Implementation of an Expert System for Transmission Planning (ESTP) using Nexpert Object," Thesis, North Carolina Agricultural and Technical State University, 1993.

8. Michael J. Cooke, M.S.E.E., "A Backpropagation Based Artificial Neural Network Method For Power Flow Analysis," Thesis, North Carolina Agricultural and Technical State University, 1993.
9. Dolapo Latinwo, M.S.E.E., "Automated Transmission System Planning," Thesis, North Carolina Agricultural and Technical State University, 1993.
10. Mohammed T. Rahman, M.S.E.E., "A Neural Network Based Frequency and Phase Sensitive Signal Classifier," Thesis, North Carolina Agricultural and Technical State University, 1993.
11. Karl Ricanek, Jr., M.S.E.E., "The Development of a Graphical User Interface for the Automated (Power) System Planning Tool in the X Windowing environment using OSF/Motif," Thesis, North Carolina Agricultural and Technical State University, 1993.
12. Felix A. Iyoha, M.S.E.E., "Power System Fault Detection Employing an Adaptive Resonance Theory (ART-1) Neural Network," Thesis, North Carolina Agricultural and Technical State University, 1995.
13. Ezenekwe J. Nwikoro, M.S.E.E, "Optimal Power System Generation Control Using an Artificial Neural Network," Thesis, North Carolina Agricultural and Technical State University, 1995.
14. Stephen Wayne Soliday, M.S.E.E., "A Subsystem Approach to Developing a Behavior Based Hybrid Navigation System for Autonomous Vehicles," Thesis, North Carolina Agricultural and Technical State University, 1995.
15. William A. Bowen, M.S.E.E., "Development of a Two-Dimensional Object Identification System Using a Gradient-Based Shape Metric and a Backpropagation Neural Network," Thesis, North Carolina Agricultural and Technical State University, 1997.
16. Guat Eng Gan, M.S.E.E., "A Two Dimensional Object Recognition System Using a Gradient-Based Shape Metric Technique," Thesis, North Carolina Agricultural and Technical State University, 1997.
17. Michael Christopher King, M.S.E.E., "Pattern Recognition Using Parallel Neural Systems," Thesis, North Carolina Agricultural and Technical State University, 1997.
18. Shailesh Hasalia, "M.S.E.E., "Study of Computer Telephony Integration and Asynchronous Transfer Mode," Thesis, North Carolina Agricultural and Technical State University, 1998.
19. Carelle L. Pierre, M.S.E.E, "Power System Monitoring and Analysis in the Engineering Complex of North Carolina A&T State University," Thesis, North Carolina Agricultural and Technical State University, 1998.
20. Donshay Martrail Chance, M.S.E.E., "An Artificial Neural Network Biometric Security System Utilizing Human Electrical Cellular Signatures," Thesis, North Carolina Agricultural and Technical State University, 2001.
21. Audley B. Darmand, M.S.E.E., "Intelligent Power System Load Modeling Using Group Method of Data Handling (GMDH) Artificial Neural Networks," Thesis, North Carolina Agricultural and Technical State University, 2001.
22. Guanghong Shi, M.S.E.E., "Component Placement on a Motherboard using Parallel Distributed Methods," Thesis, North Carolina Agricultural and Technical State University, 2004.
23. Kenneth Jarod Jones, M.S.E.E., "Human Color Discrimination Using Electroencephalographic Signals and Neural Systems," Thesis, North Carolina Agricultural and Technical State University, 2007.

24. Cory Michael Barton, M.S.E.E., "The Development and Implementationof a Testbed Unmanned Aerial System," Thesis, North Carolina Agricultural and Technical State University, 2008.

25. Wen Fang, M.S.E.E., "Power System Load Forecasting Using a Multiple Artificial Neural Network Architecture," Thesis, North Carolina Agricultural and Technical State University, 2008.

PROFESSIONAL SOCIETIES

- Institute of Electrical and Electronic Engineers – Senior Member
- International Neural Network Society – Member
- Sigma Xi, The Scientific Research Honor Society
- Tau Beta Pi - The Engineering Honor Society

HONORS

- Chancellor of North Carolina A&T State University Appointee to the Guilford GUILD for Leadership, 1997.
- Governor's Appointee for the University of North Carolina System to the State Board of Examiners of Electrical Contractors, 1996-2002.
- Community Service Award, Tutorial Programs for Disadvantage Youths, National Council of Negro Women, Columbia, South Carolina, 1988.
- North Carolina A&T State University Appointee to Honeywell Faculty Institute for Science and Engineering, Minneapolis, Minnesota, 1987.
- Minnesota Mining and Manufacturing Engineering Fellow, Innovative Methods in Pattern Recognition, Saint Paul, Minnesota, 1987 - 1990.
- Most Outstanding Engineering Faculty Award, Electrical Engineering, North Carolina A&T State University, Greensboro, North Carolina, 1987.
- Industrial Graduate Research Fellow, Clemson University, Electrical and Computer Engineering Department, Clemson, South Carolina, 1985.
- University, Harris Corporation, Miami, Florida, 1984.
- Corporate Engineering Research Fellow, Clemson University Electric Power Research Association, Clemson, South Carolina 1982-1985.
- South Carolina Graduate Fellow, South Carolina Commission on Higher Education, Columbia, South Carolina, 1982.